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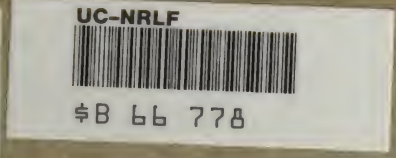

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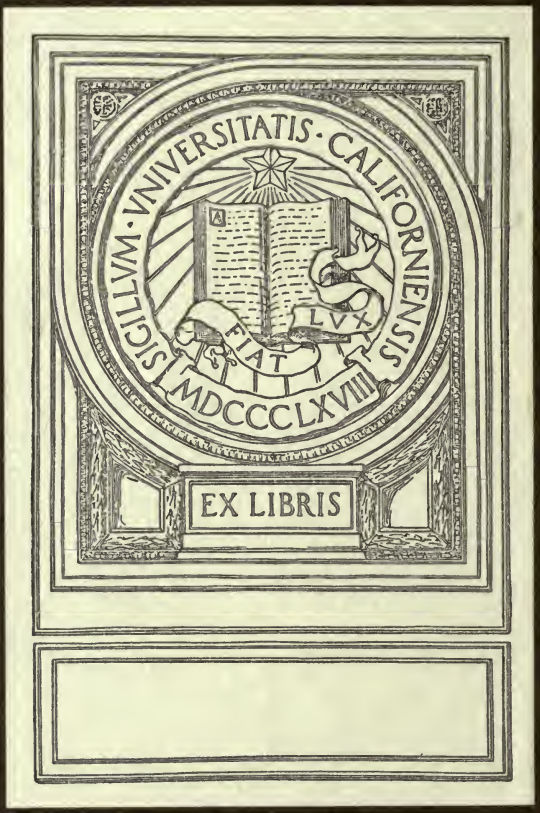
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BULLETIN
OF
THE UNIVERSITY OF TEXAS
NO. 361
SIX TIMES A MONTH

EXTENSION SERIES NO. 61 SEPTEMBER 25, 1914

Nature Study and Agriculture for the Rural Schools of Texas

BY

WILLIAM SEPTIMUS TAYLOR, M. S.
ASSOCIATE PROFESSOR OF AGRICULTURAL EDUCATION
AND
CHARLES HERMAN WINKLER, M. A.
INSTRUCTOR IN AGRICULTURAL EDUCATION

PUBLISHED BY THE UNIVERSITY OF TEXAS
AUSTIN, TEXAS

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Cultivated mind is the guardian genius of democracy. . . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

President Mirabeau B. Lamar.

The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

President Sam Houston.

TO THE
AMERICAS

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THE DEPARTMENT OF EXTENSION

Purpose. Every university should serve not only its resident student body, but also the entire community. This is true in a peculiar sense of a state university; supported as it is by the taxes of all the people, it is under business obligation to render back service to each citizen and to the commonwealth. In a general sense a university fulfills this obligation by sending educated young men and women back into their home communities to carry with them the culture of a broader outlook; the skill acquired through professional training as lawyers, teachers, doctors, nurses, home-makers, business men; and especially the inspiration of unselfish service as citizens that is the intangible and priceless asset of university life.

Taking the University to the People. This indirect contact with the whole people of the State is, however, not sufficient. The constant aim of the President and Regents has been to broaden the scope of the University of Texas with the broadening interests of the state, and to bring its benefits within the reach of as many individuals as possible. In 1898 the Summer Schools were opened and have been maintained each summer since for the convenience of students who are unable to attend the long session, especially for the teachers of the Texas schools whose professional work fills the winter months. As a further step toward making the University directly useful to large numbers of people who are unable to attend the classes of either the long or the summer session, the Department of Extension was established four years ago. This Department has developed rapidly, and its work is now carried forward under several general divisions as follows:

The Division of Public Welfare. It is the purpose of this division to go into the field and investigate the economic and social conditions in the state with a view of collecting such reliable data as may present a basis for intelligent efforts at improving such conditions. It is hoped that through this Department the citizens of the state may have the advantage of unbiased University experts, who can come to them and advise with them whenever they wish to plan any economic and social movement. The time of

one or more persons will be devoted to the various problems of rural economy, sanitation, social life, finance, marketing and kindred subjects.

The Division of Public Discussion. This division has for its purpose the encouragement and intelligent direction of public discussion and debate, both in schools and out of them. Bulletins have been issued giving advice regarding the organization of debating clubs, and furnishing lists of references for reading and preparation for debate on a number of topics. Loan libraries on important subjects, such as prohibition, woman suffrage, initiative and referendum, prison reform, compulsory education, the commission form of city government, municipal ownership of public utilities, and the tariff and free raw material, have been prepared and are being loaned to such clubs and individuals as request them. The University Interscholastic League has been successfully organized, and it is the hope of this division to assist in developing the school as a social center through which the community may become better informed. County organizations belonging to the League hold annually county contests in debating, declamation, and athletics. Every school in Texas should be interested in this work, and a League should be organized in each county. Upon request the Constitution of the League, together with bulletins and other information, will be mailed.

The Division of Home Welfare. The division deals specifically with all problems relating to the home, and exists primarily for the benefit of the home-maker and with a view of placing the home on the same intelligent and prosperous basis which characterizes other progressive institutions. Lecturers and demonstrators will attend fairs, county educational rallies, and make a limited number of engagements through the medium of women's organizations, to give specific instruction on subjects of vital interest to the home. Bulletins will be issued frequently on matters pertaining to the home and may be had on application to the Department. Questions will gladly be answered at any time on matters pertaining to the welfare of the home. Further information may be obtained by writing to the division.

The Division of Public School Improvement. This division has in charge the various educational exhibits sent out by the University to the fairs and other large gatherings, to call to the attention of the people certain needs of Texas and to point out the most intelligent methods of meeting these needs. These exhibits cover such vital subjects as school buildings and school hygiene, plays and playgrounds, use of schools as social centers, medical inspection of schools and care of the feeble-minded. Information on miscellaneous subjects is furnished through the co-operation of men in the faculty who have expert knowledge in their various fields. Ready-made lectures, accompanied by slides, are sent out to responsible people who are attempting local improvement. Short, practical bulletins have been prepared on many such timely subjects as Wholesome Cooking under Rural Conditions, Beautification of Home and School Grounds. Pamphlets have also been issued on One and Two-Room Rural School Buildings, Three and Four-Room Rural School Buildings, Remodeled Rural School Buildings. These contain full detailed drawings and detailed architect's specifications. As its title indicates, the activities of this division are diversified. The aim of the division is to be useful in the homes and in the schools of the state, and to this end correspondence with communities that desire its co-operation is invited.

The Division of Public Lectures. In the Division of Public Lectures the University undertakes to provide competent, trained, and impartial speakers, chiefly from among its faculty, to present to the people the great questions of the day, and interesting phases of literature, science, and art. It is by no means the purpose of these lectures to be merely amusing; the attempt is made to present in a popular and attractive form a definite amount of reliable instruction. A special bulletin setting forth the available lectures has been prepared and will be sent upon application.

The Division of Child Welfare. The Division of Child Welfare investigates local conditions affecting children, and assists in plans for bettering the conditions affecting childhood. The hygienic and sanitary conditions of schools have been given much study, and through bulletins, letters, and lectures help is given to school

boards in planning new schoolhouses and in remodeling old ones to make them more hygienic. The feeble-minded and delinquents have been studied and assistance given in drafting laws to care better for them. Numerous other studies will be taken up as rapidly as funds are made available. A psychological clinic will next year be established at the University to which abnormal, or atypical, children may be brought for diagnosis. At present the division gives free advice by mail on any matter pertaining to child welfare.

The Division of Correspondence Instruction. Teaching by correspondence has long since passed the experimental stage. While the University recommends resident work when residence is possible, believing that the experience of meeting and mixing with fellow students and the consequent training in real democracy, as well as the personal contact with and inspiration from the teachers, is invaluable, yet the authorities of the University also realize that correspondence study offers substantial advantages. In correspondence instruction the teaching is entirely individual; each student, no matter how diffident or how lacking in aggressiveness, comes into individual relation with the instructor in a way impossible in the crowded class-room. He recites the whole of every lesson with a consequent advantage to himself that is obvious. Full opportunity is given to discuss all difficulties in writing, and this written discussion in itself affords valuable training. Further, a correspondence student is not hampered by the usual time regulations; he may take up a study at his convenience without awaiting the fixed date of a college term, and he may push the work to completion as rapidly as he is able to master it. Moreover, correspondence work develops in a marked degree initiative, self-reliance, accuracy, and, above all, perseverance.

INTRODUCTION

The Department of Extension of the University is endeavoring to render a genuine service to the common public schools of the state, and the Division of Public School Improvement of the Department is, therefore, glad to offer this bulletin to the teachers of Texas, believing that it will be helpful in both country and city schools in which instruction in nature-study and agriculture is attempted below the high-school stage of advancement.

Agriculture is taught in the public schools of practically every state in the Union; in fact, thirty-nine of the forty-eight states, including Texas, have recognized the importance of the subject, and have enacted laws requiring agriculture to be taught in the public schools. In practically all of the other nine states the teachers, with the approval of their boards of school trustees, have forged ahead and are doing a splendid type of instruction in elementary agriculture. The outline given in this bulletin may be used with most any text-book on the subject of nature-study and elementary agriculture, and may also accompany the use of the state course of study issued by the State Department of Education.

Nature-study in the public schools has not received heretofore the prominence in the public schools that it should have. This has been due largely to the fact that the rural teachers have not had the training necessary to teach the subject successfully. Efficient instruction in agriculture has suffered from the same handicap. Provisions should be made in all teachers' training schools for more and better instruction in both nature-study and agriculture. There is nothing that will strengthen agriculture in the seventh grade so materially as effective work in nature-study in the lower grades. And there is no training that will enrich the child's life more than a study of nature.

Our educational system is a failure unless it enriches life and trains for greater usefulness. More than 90 per cent of the children in the rural schools are farmers' sons and daughters, and a large percentage of these will spend their lives on the farm. It is the proper function of the rural schools to give such training as will enable these children to live fuller and riches lives—that training which will create ideals, raise standards, and inspire them to greater achievements in their rural environment. Rural schools

should not attempt to make a farmer out of every boy that comes under their influence, nor should they educate him away from the farm. But they must teach that there is just as much opportunity for culture, for happiness, for intelligent thought and action, and as great remuneration for their efforts on the farm as in the city.

The material in this bulletin is suggested for use in the grades below the high school. It may not be practicable for the teacher to follow the outline closely; as large a part or as small a part may be used as is found helpful. Additional material will be suggested by the teacher, as well as by the pupils. The quick, alert minds of boys and girls in the public schools will often furnish more valuable suggestions for work than can possibly be carried out. Above everything else, the study of the subject should instill a love for nature, for farm life, and an ambition to live contentedly in the open country.

Messrs. Taylor and Winkler, the authors of this bulletin, are entirely competent to give help in this important phase of public school education.

F. M. Bralley,
Director.

NATURE STUDY AND AGRICULTURE

IMPORTANCE.

The normal child is naturally interested in nature. If he is to get from life all the pleasure and enjoyment that is in store for him, if he is to live completely, this natural quality of his mind must be cultivated. In the hands of the skillful teacher, the natural endowment of the child should be so directed as to enable him to appreciate the beautiful in life, to explore new fields, to delve into new subjects, and to gather information for himself from the great realm of nature. Nature spreads out an inexhaustible supply of material of wonderful beauty, of never failing interest, and of great economic importance within the reach of every one. The child whose teaching has been such as will enable him to gather from this that which enriches and delights his mind and broadens his knowledge is fortunate indeed.

FIELD EXCURSIONS.

In all the work in nature study and agriculture, field excursions are of supreme importance for the purpose of getting observations at first hand. The teacher who would increase the interest of his pupils in the world of nature and who would familiarize them thoroughly with farm conditions and farm problems, must make numerous excursions with his classes. Each excursion should be planned beforehand and should have some definite object in view. On all excursions lead the children to talk about the things they see. Encourage the kind of training that will help them to interpret the material world with which they come in daily contact.

COLLECTING AND PRESERVING MATERIAL.

In addition to the field excursions the children should be encouraged to bring specimens of plants, insects, grains, stones—anything they find of interest to them—to the school building. The school should have a small museum, and should add to it any material collected of unusual interest. This museum should be made up of the common plant and animal life, of stones, old

birds' nests, Indian relics, etc. The smaller plants may be pressed between blotting paper and preserved nicely. Butterflies, moths, grasshoppers, beetles, etc., may be caught in insect nets, killed in cyanide jars or with formalin, pressed into good form, and mounted in various ways. The common method of sticking a pin through the body of the insect and into a piece of cork or wood from a cigar box is perhaps the easiest method and is fairly satisfactory. They should be preserved in a glass-covered case. It is well to place a small amount of carbon bisulphide in the case frequently to prevent moths from destroying the mounted specimens. Soft larvae, caterpillars, grubs, lizards, snakes, etc., may be preserved in 75 per cent alcohol, or better still, in a 5 per cent formalin solution. Life histories of many of the more important insect pests should be shown in the collection. It will be found a relatively easy matter to work up a museum of great educational value to the community.

PLACE ON THE DAILY PROGRAM.

A large number of teachers give as an excuse for not teaching nature study and agriculture that they have no time for it on the daily program. The work in the first six grades should not be given a separate period on the daily schedule. It should be correlated with the work in English, reading, geography, arithmetic, manual arts, sanitation, and hygiene, etc. It furnishes an abundance of the most interesting material to be obtained for language work and will help to lend interest to this frequently dry and uninteresting subject. It vitalizes all the other subjects in the same way and makes them much more easily taught. There is no excuse for a teacher's failing to give instruction in nature study and agriculture. Many teachers make the opening exercises in the morning a nature study hour and get excellent results from the work. The work in the seventh grade, however, should be given a place on the daily program. Every child in the rural schools should receive such training in agriculture as will give him a greater appreciation of farm life and help him to understand the fundamental, elementary principles underlying successful farming.

THE LABORATORY AND THE SCHOOL GARDEN.

Other excuses that are frequently given for failing to give instruction in agriculture are that the schools have no laboratories, no apparatus, and no experimental farms or school gardens. A live, wide-awake, energetic teacher would never give any one or all of these as an excuse. The whole neighborhood is the laboratory of the rural school. The equipment on every farm, together with such supplies as may be devised by the resourceful teacher is the apparatus needed, and each farm in the community is an experimental farm. The class-room instruction can be greatly strengthened if it is possible for a school to equip itself with a working laboratory in agriculture, but it is not essential to effective work. The school garden in Texas at present is problematical. The work will be made more interesting and more helpful by giving a large amount of concrete work. But unless provision can be made for caring for the garden during vacation, all garden work or farm work should be made home project work. This is a very satisfactory way of giving such work and will vitalize the instruction in the class-room and the laboratory.

THE LIBRARY.

The idea of a rural school library is comparatively new in most rural communities. The movement is fast gaining ground, however, and nearly all schools now attempt to keep some kind of reading material which is generously called the library. It is possible today for any school, however poor it may be, to equip itself with a good reading library in nature study and agriculture. The United States Department of Agriculture at Washington, D. C., and the experiment stations in the different states publish a large amount of valuable material monthly for the farmers of the nation. These publications cover every phase of farm life and the majority of them are written so that any seventh grade child can understand them. The Biological Survey of the Department of Agriculture has published a great many helpful bulletins on birds, and most of them may be obtained upon request. The state experiment stations also have many available bulletins along nature-study lines. These are not supposed to be sent free outside of the state

in which they were printed, but most of them may be had for the asking. Every school should procure just as many of these bulletins as can be used. They should be bound in a good, stiff binder so that they will not be torn up so easily. A good binder for this purpose may be obtained from Gaylord Bros., Syracuse, N. Y., at a merely nominal price. In addition to the bulletins the school should have a good working library in nature study and agriculture and should also have a number of books on country life literature. The bibliography in the back of the bulletin will suggest a number of books that will be found worth while in every rural school library.

FIRST GRADE

The work in the first grade must be very elementary. Begin working with the things with which the children are most familiar. Encourage them to talk about the things in which they are most interested. Never discourage them regarding any of their interests. The teacher must be an enthusiast in the work if he would have the children enthusiastic.

I. PLANTS.

1. Seeds and Seed Germination. Give simple exercises in seed germination, using two tin plates or pie pans, and blotting paper or cotton flannel, to show the need of water in germination and to give familiarity with a few of the common garden and field seeds. All seeds used for germinating purposes should be brought from the homes in the community. Let each child bring seed from his home. Create a little wholesome rivalry for the highest and strongest germination. It adds a great deal to the interest.

2. Flowering Plants. Gather and note the perfume of the most common and most attractive flowering plants in the community. Teach pupils to name and recognize such common flowers as blue bonnets, verbenas, primroses, violets, pansies, nasturtiums, zinnias, daisies, sunflowers, coreopsis, etc. Have the children bring the common wild flowers and such cultivated flowers as they have at their homes to school. Teach them how to gather them so as not to injure the plants.

3. Weeds. Teach how to recognize such common weeds as crab grass, fox tail, bitter weed, pigweed, pepper grass, cockle bur, thistle, rag weed, nettle, tie vine, blood weed, etc.

4. Forest Trees. Teach pupils to name and recognize the oaks, hickory, elm, pine, sycamore, pecan, hackberry, mesquite, and other common trees. Teach them to name the trees on the school ground. Collect leaves from these trees,

press them and save for use in naming the trees and for drawing lessons during the winter.

5. Fruits and Vegetables. Study the fruits and vegetables growing in the community. Bring specimens of each to school. Discuss the color, odor, taste, and use of each.

II. ANIMALS.

1. Domestic Animals. Study the horse, cow, sheep, pig, goat, dog, and cat, noting the ways in which they are useful to us; the food they eat; the difference in the manner of taking and chewing their food. Study the heads and feet of these animals. Note those animals that have horns. Note the shape and position of the ears of different animals. Study animals that have hoofs; list those that have solid and those that have cloven hoofs. Compare the feet of the dog and the cat with the feet of the horse and the cow.

2. Wild Animals. Make a list of all the wild animals the children can name; a list of those that the children have seen; a list of the wild animals that are dangerous to man; a list of those that are used as food. Study the habits, food, and home of the prairie dog, jack rabbit, squirrel, coyote, cottontail, rat, mouse, and skunk. Tell the children stories of wild animals and encourage them to tell the stories they have heard.

3. Pets. Stories of how they come to be made pets.

4. Birds.
   a. Turkeys, geese, guineas, ducks, chickens, peafowls, and pheasants. Study their use to the farm home; their habits and general appearance.
   b. Learn to recognize and name such birds as the mockingbird, crow, robin, English sparrow, house wren, blue jay, purple martin, screech owl, oriole, hummingbird, dove and quail.
   c. Study in detail the house wren, observing especially
      1. Place of nesting.
      2. Material used in building the nest.

3. Time of nesting.
4. Number of eggs in the nest.
5. Size and color of eggs.
6. Incubation period.
7. Kind of food given nestlings.
8. Food of adult birds.
9. Frequency of feeding young.
10. Whether mother bird, her mate, or both feed young.
11. Number of broods per season.

d. Arrange to feed birls with fragments from the lunch baskets. The food may be placed on the window sills, on a piece of board fastened up in a tree, or in any place where the birds may be attracted to it. They will be shy about eating this food at first, but with a small amount of coaxing they will become quite tame.

5. Insects. Learn to recognize and name such common insects as the grasshopper, cricket, butterfly, lady bug, bumblebee, honey bee, moth, potato bug, etc. Discuss their homes, feeding habits, and methods of moving about.

III. HOMES OF MAN.

Study the wigwam, Eskimo hut, log cabin, and a modern home. Procure good pictures of each of these. Have the children bring pictures of each from their own homes and encourage a discussion of each picture. Tell the children stories of the early inhabitants of the country and their manner of living. Have the children cut out wigwams from paper and help them to construct an Indian village. Compare the way the early pioneers lived with present-day life.

IV. NOTES ON THE WEATHER.

Observe the weather changes and their effects upon nature. Observe the direction of the wind in cool weather; in warm weather. Note the effect of cool weather on growth; of warm weather on growth. Observe the effect of frost and freezing on vegetation.

SECOND GRADE

The work of the second year should differ very slightly in its content from the first year's work. Do not attempt too great an enlargement. The pupils have a slight knowledge of the things studied before; their power of observation has been increased to some extent; they have a little broader viewpoint; they are some stronger because of their previous work. But they are not capable of grasping a great many new facts. The work will be more interesting and more helpful to them if only a small amount of new material is added, and the old material is presented in a slightly new form.

I. PLANTS.

1. Seeds and Seed Germination. Simple exercises in germination, using a sand box or sawdust instead of the tin pans and blotting paper. All three of these may be used. Use seed from the homes in the neighborhood. Make several tests in germination to show the need of moisture. Keep some of the tests moist after the seeds germinate and give others no water at all. Observe the difference.

2. Flowering Plants. Continue the study as in the first grade. In addition to the flowers studied the first year, study the dandelions, thistles, sweet peas, poppies, Indian blanket, holly hocks, hyacinths, and jonquils. Have the children bring bouquets of wild and cultivated flowers for study and for the teacher's desk. Show them how to arrange flowers to make them attractive.

3. Weeds. Review the weeds studied the previous year until the children can identify and name each one. In addition to these learn such common weeds as lamb's-quarters, purslane, barnyard grass, buffalo bur, shepherd's purse, and others of the most common and most troublesome weeds in the community.

4. Plants that do not Bear Flowers. Ferns, mosses, lichens, etc. The children should be taught to recognize some of these plants. If possible, let them gather their own

specimens; but if they are not able to find them, the teacher should provide specimens of each.

5. Forest Trees. In addition to the trees studied in the first year, study the cedar, walnut, birch, poplar, magnolia, sassafras, persimmon, ash, and any other trees found in the community. Make a collection of leaves of all the trees studied, press them, and save them for use in drawing and naming. Gather seeds, nuts, and fruit from the trees in the vicinity and keep them for winter study.

6. Fruits and Vegetables. The apple, pear, quince, peach, fig, orange, grape fruit, grape, strawberry, watermelon, cantaloupe, beans, peas, radishes, cabbage, onions, turnips, tomatoes, potatoes, cucumbers, parsnips, beets, and okra. Discuss the color, odor, taste, method of growth, size, general appearance and use of each; which are usually served raw and which cooked; at which meals usually served. Have children bring specimens of every fruit and vegetables grown at their homes.

II. ANIMAL LIFE.

1. Domestic Animals. List of domestic animals in the community. Study more fully the ways in which they are useful to us. Observe their food habits more closely. Watch a cow chewing her cud. Of what is it composed? Why do they chew cuds? Discuss the peculiar characteristic features and movements of the various animals. Note the different ways of lying down, getting up, walking, running, jumping, etc. Have the children observe the peculiar habits of each animal and report their observation to the class.

2. Wild Animals. List of all the wild animals the children can name. List of those found in the United States; in Texas. Animals becoming extinct. Reasons for extermination. Continue the study of the animals studied in the first grade. If possible, capture a prairie dog, put him in a cage and keep him at the school building for study. Have the children observe all his habits closely. Study

a mouse and a rabbit in the same way. Make all the observations possible while studying them in their natural homes. Collect pictures from every known source for use in these studies.

3. Pets. Guinea pigs, rabbits, white rats, white mice, raccoons, etc.

4. Birds.
   a. Continue the study of the domestic fowls, observing more closely their general appearance, their nesting habits, their feeding, and their general habits. Discuss fully their use on the farm; the use of their eggs; use of their feathers.
   b. Learn to recognize and name, in addition to all the birds learned in the first grade, the scissor-tailed fly catcher, road runner, sparrow hawk, shrike, painted bunting, dickcissel, blue bird, cliff swallow, song sparrow, and chickadee.
   c. Select the first bird found nesting for the detailed study outlined for the wren in the preceding grade unless that first bird is the English sparrow. Do not use this pest for the study until later.
   d. List of migratory birds seen during the year.
   e. List of resident birds.
   f. Provide nesting places for birds on the school grounds by fastening gourds, tin cans, and boxes in the trees. Observe closely the nesting habits of the birds studied and see which ones might be induced to nest in the places provided.

5. Insects. Collect such common insects as are suggested in the work for the first grade and others common in the community, and bring them to the school-room for study. Have the children count the number of pairs of legs and wings; the number of parts of the body; examine the mouth parts; help them to locate their eyes and their breathing pores. Bring out the most interesting points about each specimen. Learn such insects as the walking stick, dragon fly, katydid, and mud-dauber. Study the home and habits of the

mud-dauber. The house of one of these peculiar insects may be found around the school building. Study its food habits and its home carefully.

6. Toad.
   a. General appearance.
   b. Color. Reasons for being so colored.
   c. Number of feet.
   d. Number of toes on each foot.
   e. Where found in late summer and early fall.
   f. Kind of food.
   g. Time of feeding.
   h. Manner of drinking.
   i. Have the children assist in making an aquarium in which a toad may be kept and fed. Let the children procure the food for it and find out for themselves the different kinds of food and the amount a toad will eat.
   j. Have the children count the number of toads around their homes, on the school grounds and the number seen on excursions.

III. HOMES OF MAN.

Continue the study as suggested in outline for the first grade.

IV. NATURAL PHENOMENA.

1. The Weather and the Seasons. Learn the names of the seasons and the months that make up each. Observe the different activities on the farm during each season. Discuss the seasons of planting and harvesting; the seasons of growth and dormancy. Note the shortening of the days and the position of the sun as the days grow shorter. Watch the sun's position change as the days become longer in the springtime. Keep a calendar showing fair days, cloudy days, rainy days, hail storms, snowfalls, and the dates of the first and last frost.

2. The Great Bear, the Little Bear and the Milky Way. Stories of each telling why they are so named.

THIRD GRADE

The work of this grade is a further enlargement of the work in the first two grades and is designed to enlarge the child's conception of the world of nature. The children should enter the third year with a much broader outlook into nature. Their powers of observation should be greatly quickened and they should be able to go more into detail than formerly. The teacher must give them every opportunity to get first hand observations and must help them to see things more clearly. They will be accumulating a store of knowledge in this and all future years and will need a great deal of help in classifying it properly. The teacher must direct their thinking very carefully and must be always ready to correct mistakes, make careful explanations, and help them to get accurate information.

I. PLANT LIFE.

1. Seeds.
   a. Make simple germination tests with seeds of different sizes to show the effect on the strength of the plant. For these tests small and large kernels of corn, and small and large kernels of wheat may be used.
   b. Make germination tests under different temperatures to show the effect of heat on germination.

2. Flowering Plants.
   a. House plants. Learn to recognize and name some of the more common house plants, such as the begonia, geranium, primrose, hyacinth, pansy, etc.
   b. Plants used for decorating the home grounds and grown in the flower garden. Learn to recognize and name at least ten. Roses, lilacs, honeysuckle, poppies, larkspur, lilies, etc., are good specimens for study.
   c. Wild flowering plants. Corn flower, Queen Anne's lace, yarrow, phlox, salvia, etc.

3. Ornamental Plants Other Than Flowering Plants.
   a. Ferns: brake, Christmas, and maiden hair.
      1. Study ferns in their natural homes if possible.

2. Conditions suitable for growth.
3. Care of ferns when used for decorative purposes in the home.

4. Other Ornamental Plants.
   Coleus, Virginia creeper, arbor vitae, etc.

5. Weeds.
   a. List of ten weeds troublesome in the garden.
   b. Ten weeds that are general farm pests.
   c. Collect seeds from five of the most common weeds in the community. Learn to identify the weed by its seeds.

6. Trees.
   a. Learn to recognize and name
      1. Three nut trees.
      2. Three fruit trees that grow wild.
      3. Three trees beautiful for their flowers.
      4. Three evergreens.
   b. Prepare an exhibit of nuts collected from the nut trees.
   c. Prepare an exhibit of fruit gathered from fruit trees in the community.
   d. Make skeleton drawings of type trees, showing direction of limbs.
   e. Make mass drawings of type trees, showing form of top.
   f. Compare the leaves of the maple and the oak; the elm and the hickory; the walnut and the sycamore. Draw.

7. Fruits and Vegetables.
   a. List of tree fruits grown in the community.
   b. List of vine fruits.
   c. List of the common garden vegetables.
   d. Uses of fruit and vegetables.
   e. Exhibit of product grown on home plot.
   f. Care and handling so as not to injure.

II. ANIMAL LIFE.

1. Domestic Animals. Follow suggestions for the first and second grades, studying more in detail the relation of domestic animals to agriculture. Discuss care, shelter, and

feeding of live stock. Teach kindness to farm animals. Interest the children in the work of the humane society. If there is a humane officer accessible, have him tell the children of his work.

2. Wild Animals.
   a. Wild animals at large in Texas today.
   b. Wild animals in the zoo.
   c. Wild animals in shows.
   d. Methods of capturing.
   e. Special studies of the buffalo and elephant are desirable in this grade. If a show comes within reach during the year, encourage the children to see it. Have them report all their observations.

3. Birds.
   a. Domestic fowls.
      1. Season of laying for different classes of poultry.
      2. Number of eggs that a hen, turkey, goose, guinea, duck, or peafowl should lay in one year.
      3. Brooding habits of domestic fowls.
      4. Period of incubation of eggs of each.
      5. Poultry census of the neighborhood.
   b. Wild birds.
      1. Continue the study as in first and second grades. The children should be able to name and identify a large number of our common birds by the time they have finished this grade. In addition to the twenty-four birds learned in the first two years, learn the tit-mouse, vireo, red-headed woodpecker, flicker, chuck-will's-widow, myrtle warbler, cedar waxwing, pine siskin, cow bird, meadow lark, Carolina wren, and rock wren.
      2. Study the nests of different birds. A number of old nests may be collected during the winter season and brought to the school building. Make careful studies of the nests of the vireo and oriole. Note the materials used in building and the method of attaching.

3. Detailed study of the oriole or vireo.
4. Convert crayon boxes and packing boxes into bird houses and place them in the trees on the school grounds and at home.
5. Place suet or bones in the trees and watch the woodpeckers, nuthatches, chickadees, and titmice feed on it.

4. Insects. The children should continue to acquaint themselves with insect life and should learn as many different insects as possible. They should learn to distinguish between butterflies and moths by examining the antennae. Compare a grasshopper and a spider. Observe the difference.

a. Life history of insects.
   1. Egg stage.
   2. Larva or grub stage.
   3. Pupa stage.
   4. Adult or full grown insect.

Note.—Use the tent caterpillar in studying the life history of insects.

b. Butterflies.
   1. Learn to recognize such common forms as the cabbage butterfly, monarch, black swallowtail, tiger swallowtail, etc.
   2. Detailed study of the monarch butterfly.
      a. Migration habits.
      b. Food of adult and larva.
      c. How protected from birds.
      d. Life history.
      e. Observe these butterflies during the migration seasons; catch some of them and bring them to school for study.

c. Moths.
   1. Learn to recognize some of the most common sphinx moths and any other forms common in the vicinity.
   2. Examine the moths closely and compare with butterflies.

3. Note position of wings when resting; when feeding. Compare with butterfly.
4. Procure cocoons and keep them until the moths come out of them. Have each child study the life history of at least one moth in this grade.

d. The house fly.
   1. Life history.
   2. Habits.
   3. Diseases which it spreads.
   4. Methods of combating.
   5. Home-made fly traps.

e. Mosquito.
   1. Life history. Find a raft of mosquito eggs and place in an aquarium. Let the children watch development.
   2. Breeding places of mosquitoes.
   3. Means of killing larva and pupa.
   4. Necessity of co-operation in fighting the house fly and mosquito.
   5. Relation of mosquitoes to malaria and yellow fever.

f. Ant.
   1. Kinds in Texas.
   2. General habits.
   3. Food habits.
   4. Destructive kinds.
   5. Methods of destroying.

5. Toad.
   a. Life history. Place some spawn in the aquarium at the school. Have the children make daily observations.
   b. Time of spawning.
   c. Number of eggs laid.
   d. Length of life of toad.
   e. The tadpole as a scavenger.
   f. Value of the toad as an insectivorous animal.
   g. Enemies of the toad.
      1. Insectivorous birds.
      2. Birds of prey.

3. Snakes.
4. Killed by wheels of vehicles, trodden on by live stock, etc.

III. HYGIENE AND SANITATION.

There should be given in every grade some hygiene and sanitation. It must of necessity be very elementary in the lower grades, of course. But even in the first and second grades the children can be taught a great many things of vital importance to their health. Cleanliness, correct postures of standing and sitting, deep breathing, proper ventilation during work and rest, and good habits of living can be taught from the first grade.

IV. NOTES ON THE WEATHER.

Continue to keep a calendar showing the fair, cloudy, rainy days, etc. Also learn to read the thermometer and record the temperature of each day for a month. Observe the altitude of the sun at noon during the different seasons of the year. Notice the time and place of the rising and setting sun during the different seasons.

V. RELICS.

Collect relics of all kinds for the museum. Indian arrow points, spears, hatchets, tomahawks, etc., should be collected and placed in every museum. Have the children read stories of the Indians and tell them the use made of each of the relics.

FOURTH GRADE

The fourth year's work may be more intensive than previous work. Practically all the work in the first three years has been extensive. The third grade child should begin doing some work in detail. The child in the fourth grade is usually curious to know all that he can learn about everything he sees. He can ask questions until he sometimes becomes tedious. Do not discourage this investigative nature. Direct his questions in so far as necessary, but find time to answer every one as fully as possible. Help him to discover things for himself. Give him freedom to do and think independently. Develop within him a desire to know, and aid him in his investigation just as far as help is profitable to him. Let him do things largely on his own initiative. The teacher must be careful not to give too much aid and yet he must ever be ready to indicate the line of work and to direct the student's energies in the proper way.

I. PLANT LIFE.

1. Seeds.
   a. Make simple germination tests with seeds of different ages to test the effect of age on vitality. Use tomato and lettuce seeds, one, two, and three years old; corn, oats, and wheat, one, two, three, and four years old and older if it is possible to procure older samples. Compare the results of the tests.
   b. Learn to identify and name the seeds of all the common farm and garden crops. Note the different shapes, sizes and colors of the different seeds. Observe the size of the plants produced by the different seeds. Compare the seeds of corn and sorghum. Compare the plants of the same.
2. Parts of the Plant. Roots, stems and leaves.
3. Functions of Each Part.
4. Flowering Plants.
   a. Continue the study of house plants as in the third grade. Learn to recognize and name such plants as narcissus, wandering-jew, etc.

b. Plants used for decorating the home grounds. Oleander, wisteria, clematis, verbenas, dahlias, cannas, cosmos, periwinkle, asters, princess feather, chrysanthemums, etc.

c. Wild flowering plants. Elder, mountain laurel, Texas plume, etc.

d. Analyze some of the simpler flowers and learn their different parts. The child should be familiar with the terms stamen, anther, pistil, ovary, corolla, calyx, petals, sepals, and bracts.

e. Wild flowers troublesome as weeds. Queen Anne's lace, ox-eye daisy, yarrow, wild verbena, dandelion, sunflower, wild morning glory.

f. Flowering plants escaped from cultivation that have become pests. Larkspur, bouncing-bet, snap-dragon, chicory, etc.

5. Other Ornamental Plants.

a. Shrubs. Common privet, tamarix, ligustrum, crepe myrtle, pomegranate, etc.

b. Vines. Morning glory, sweet pea, smilax, woodbine, clematis.

c. Other plants.

6. Weeds.

a. Name and identify fifteen of the most common weeds in the locality. Collect seeds from these weeds and put in glass vials. Learn to recognize the weed by its seeds.

b. Examine the seeds of thistles, milkweeds, and dandelions. Observe the parachute effect, making it easy for the wind to carry them great distances. Examine the seeds of the linden, maple, and pine. Note the ways in which these would be most easily transported.

7. Trees.

a. List of nut trees in the community.

b. List of fruit trees, wild and cultivated.

c. Trees valuable for timber.

d. Trees used for shade and ornamental purposes.

e. Plant seeds and nuts from forest trees in a seed bed.

f. Go into the forest and take up some of the small seedlings and transplant them on the school ground. Have the fourth grade do this as a grade, and let all the trees they transplant be known as their trees. Give them instructions in the method of digging up the tree, in root and top pruning, and in planting.

8. Fruit and Vegetables.
   a. Continue the study as suggested in previous grades. The child should be able to name and identify all of the common fruits and vegetables by the time he has completed the fourth year's work, and should know something about the importance and uses of each.
   b. Procure as many specimens of fruits and vegetables not common to the community as possible, and tell the children where they are grown and a few interesting facts regarding them. Have the children locate the regions of growth on maps.

II. ANIMAL LIFE.

1. Domestic Animals. The children should be interested in better live stock in this grade. Visit farms and look at different farm animals. Observe the different breeds of cattle, hogs, and sheep found in the community. Compare thoroughbred animals with scrubs. Continue the study of care, shelter, feeding, and kindness to all forms of dumb animals.

2. Wild Animals.
   a. Valuable.
      1. Fur bearing.
      2. As food for man.
      3. Hides used for leather.
   b. Harmful.
      1. Those destructive to growing and stored crops.
      2. Those that prey on other animals.
   c. Uses of furs and leather.
   d. Methods of capturing animals for the zoo.
   e. Methods of destroying animal pests.

f. Read stories of hunting in class. Tell the children stories of the buffalo and other animals that are being rapidly exterminated. Interest them in game laws and the protection of animal life.

3. Birds.

a. Poultry.

1. Different breeds of chickens, turkeys, and ducks and geese in the neighborhood.
2. Breeds of chickens known as egg producers.
3. Care of poultry.
4. Have each child keep a nesting and brooding record of a turkey or a goose. He should report on time and place of nesting, materials used in building, peculiarities of the bird while nesting, number of eggs laid, incubation period, etc.

b. Wild birds.

1. A complete list of the birds observed in the community during the year.
2. Learn to recognize them at sight and by their call notes and songs.
3. Observe carefully the feeding habits of different birds.
4. List of migratory birds seen in the spring.
5. List of migratory birds seen in the autumn.
6. List of summer residents.
7. List of winter residents.
8. Birds resident all the year.
9. Study in detail the blue jay. Discuss his good and bad traits and decide which are dominant.
10. Study the plumage of all the birds observed very carefully. Compare them in beauty. Teach the esthetic value of birds.

4. Insects. It is the purpose of the study of insects in this grade to become familiar with as many common insects as possible, with the life histories of a very few of the most common, and to learn to some extent the relation they bear to farm crops.

a. Learn to recognize and name an insect enemy of the following: corn, wheat, alfalfa, beans, peas, cotton, potatoes, cabbage, melons, berries, peaches, plums, roses, tomatoes.

b. Study the bumble bee and the honey bee, noting especially their homes, their method of collecting and carrying food to their homes, their influence on the pollination of clovers and fruits.

c. Insects injurious to public health. Continue the study of the fly and mosquito, and take up a brief study of the flea and the bedbug.

d. Insects injurious to animals. Tick, bot-fly, sheep gad-fly, lice, etc.

e. Enemies of insects. Birds, toads, other insects, man, etc.

f. Collect and mount a few insects important in relation to agriculture.

5. Snakes, Lizards, Terrapins and Turtles. Place a horned toad, a chameleon, a terrapin, a green snake, or a turtle in a screen cage and provide food for it. Observe its habits of feeding and its peculiar characteristics. Examine the heavy case that encloses the terrapin and the turtle. Note the slowness of travel of these clumsy creatures as compared with the speed of other animals. Study nature's method of protecting her life forms.

6. Earth Worms.

a. Life history.

b. Food.

c. Time of feeding.

d. Depth of burrowing.

e. For a study of the earth worm, the children will have to use their lanterns at night. The aquarium or a large box may be filled with sand or loose garden loam and three or four large earth worms placed in it. Study the way in which they burrow. Place some green grass or some dead leaves on the surface and watch results.

III. SANITATION AND HYGIENE.

Care of the scalp, teeth and nails. General problems of sanitation. Care of the home; care of the sink and refrigerator; ventilating and airing of storage rooms, basements, cellars, etc.

IV. NOTES ON THE WEATHER.

Study the cause of rain, snow, hail, ice, frost and dew. (Correlate with geography.) Observe the effect of each on vegetation, on the earth's crust, and on soil conditions.

V. ADOBE HOUSES.

If possible, visit an adobe house and study its construction. Read stories of the early inhabitants of these houses and their civilization. Compare with the Indians in other sections.

FIFTH GRADE

In the fifth grade economic features will begin to be of more interest to the child, and the work should be directed along these lines. He will want to know why and how certain insect pests and fungus diseases are injurious and how they may be controlled. He will be interested in knowing more about the damage done by weeds and about methods of control; about the value of birds, not for their beauty and song alone, but as friends of agriculture. His interest in things about him is greater than ever before, and with this increase in interest comes a corresponding increase in his power of observation. And just at this stage, the stage when the child really begins to investigate and compare, he is liable in his haste to draw erroneous conclusions. Help him to satisfy himself—to really see things before he expresses himself. This habit should be formed early in life, and the teacher of nature study has a wonderful opportunity to develop it in the life of the child.

I. PLANTS.

1. Seeds.
   a. Make germination tests of corn, beans, peas, and cotton, using sawdust testers made by the boys.
   b. Study grains of corn, dry and soaked. Note the solidity, general appearance, cotyledons, embryo, husk, etc.
   c. Study plants growing in sawdust. Note the root system. Observe the root hairs.
   d. Study and make drawings of plants at different stages of growth.
   e. Study the conditions suitable for seed germination.

2. Flowers.
   a. Cultivated.
      1. List of cultivated flowers.
      2. Preparation for planting some of the most common.
      3. Time of planting.
      4. Care of growing plants.
      5. Time of blossoming.
      6. Enemies and their control.

b. Wild.
   1. Kinds.
   2. Distribution.
   3. Conditions suitable for growth.
   4. Time of blossoming.
   5. Manner of reproduction.
   6. Protection.

c. Analyze a few of the more simple flowers, identifying the parts. Draw a few, labeling each part. The child should be quite familiar with the terms suggested in the work in the fourth grade by the time he has completed his fifth year's work.

d. Teach the esthetic value of flowers. Every rural school should have a garden of the native wild flowers on the school grounds.

3. Ferns, Vines, and Shrubs. Continue the study of these and other plants used for ornamental purposes.

4. Weeds.
   a. Name and identify twenty of the most troublesome weeds in the community. Collect seeds from these weeds and put them in screw cap glass vials. Learn to recognize the seeds of each weed studied.
   b. Classify the weeds studied as to length of life.
      1. Annuals.
      2. Biennials.
      3. Perennials.
   c. Collect specimens of the most troublesome weeds and press them. Save them for winter study.
   d. Study the habit of growth, manner of dissemination and method of eradication of a few common weeds.

5. Mosses, Lichens and Algae. A brief study of each as to habit of growth, method of reproduction, economic importance, etc.

6. Trees.
   a. Complete list of nut trees, fruit trees, trees valuable for timber, shade trees and ornamental trees as outlined for the fourth grade.

b. Observe the time of leafing out in the spring. Report observations to the class.

c. Winter study of trees. Learn to identify trees in their natural habitat, noting the kind of soil and the amount of moisture they seem to like best. Compare the willow and the cedar; the birch and the hackberry; the cottonwood and the liveoak.

7. Fruits.
   a. Tree fruits.
   b. Bush fruits.
   c. Vine fruits.
   d. Special study of the wild fruits. The dewberry, wild grape, persimmon, and algerita are good examples for study. Note the methods of reproduction, age and season of bearing, kind of flowers borne, etc.
   e. Plant wild grape vines and persimmon trees on the school grounds.

8. Vegetables. Special study of the cabbage and tomato as to
   a. Production of plants in hotbeds.
   b. Size of transplanting.
   c. Kind of soil adapted to growing.
   d. Preparation of soil for transplanting.
   e. Method of transplanting.
   f. Cultivation and care of plants.
   g. Varieties.
   h. Uses of crop.
   i. Packing, shipping and marketing.
   j. Enemies and their control.

II. ANIMAL LIFE.

1. Farm Animals. The characteristics of the different breeds of farm animals may be taught very effectively by the use of pictures obtained from agricultural bulletins, newspapers, experiment stations, breeders, etc. Every rural teacher should procure a large number of these for the work. If there are any pure bred animals in the community, take the class out to see them. Study and compare them with

other animals. Study carefully the animals in the pictures and compare them with animals in the community.

2. Use of Clippings and Pictures. Have children take clippings and pictures from every available source. Mount each picture on cardboard, find a clipping describing the picture, and paste it on the back of the mount.

3. Animal Census of the District.

4. Evaluation of Live Stock. Have each child get figures from his father giving the approximate value of the herds of different classes of farm animals on his own farm. Let him determine the average value of the individual animals and the total value of live stock reported.

5. Barns. Look into the farm accommodations for live stock. Observe very carefully the plans and construction of the best barn near enough to visit. If it is possible to visit a barn under process of construction, do so. Note very carefully the plans, materials used, source of materials, names and locations of different parts, such as joists, rafters, studding, sleepers, sills, etc. Note conveniences and labor-saving devices.

6. Birds.
   a. Poultry.
      1. Types of chickens.
         a. Egg type.
         b. Meat type.
         c. Game type.
      2. Name two prominent breeds under each type.
      3. Types and breeds known to the students.
      4. Types and breeds most profitable to the farmer.
      5. Value of turkeys and chickens as insect destroyers.
      6. Cost of keeping a chicken a year if kept in chicken lot.
      7. Number of eggs a hen must lay to pay her board, when eggs are worth 20 cents per dozen.
      8. Cold storage eggs.
      9. Shipping eggs by parcels post.

b. Wild birds.

1. Water birds.
   a. Swimming birds. Ducks, geese, terns, grebes, loons, gulls, pelicans, etc.
   b. Wading birds. Storks, bitterns, herons, cranes, rails, gallinules, etc.
2. Shore birds. Phalaropes, stilts, snipes, sandpipers, curlew, killdeer, plover, etc.
3. Game birds. Grouse, quail, partridge, prairie hen, pheasant, dove, etc.
4. Birds of prey. Eagles, vultures, hawks, and owls.
5. Land birds other than game birds. Warblers, sparrows, cuckoos, woodpeckers, thrushes, blackbirds, swallows, wrens, tanagers, buntings, finches, fly catchers, thrushes, chickadees, nuthatches, titmice, vireos, etc.
6. Learn to recognize and name a few swimming and wading birds and as large a number of the others as is possible. Study the food habits of all the birds and their relation to all life.
7. Study in detail the mockingbird, blue jay, wood pewee, cliff swallow, and other birds. Assign a different bird to each two students and let them report their observations in full.

7. Insects. Every child who lives in the country knows that the cabbage worm causes a great deal of trouble and heavy losses. He knows, too, that apples and plums are "faulty" when they drop off in large numbers before maturity, but he does not know the real cause of this dropping. He does not know that there is such a thing as a codling moth, or a plum curculio, or, if he does know, he does not know how to combat them. He has no idea about the damage done annually by the insects in the United States. If he were told that grasshoppers cost the nation more than $50,000,000 yearly, he would scarcely believe it. Study carefully the relation existing between the insect and the plant world.

a. Insect pests.

1. List of insect pests of the most common crops.

2. Probable amount of damage done in the community.
3. Best methods of eradication.

b. Beneficial insects.
   1. List of beneficial insects in the community.
   2. Ways in which they are beneficial.
   3. Means of protecting.
   4. Study the honey bee, bumble bee, lady bug, ichneumon fly, dragon fly, etc.

c. Insects injurious to health. Continue the study of the house fly, mosquito, flea, bedbug, lice, and red bug or chigger.

d. Other household insects and methods of combating them. Cockroach, clothes moth, ants, etc.

e. Spiders. Habits, food, methods of procuring food, egg bag, number of eggs in bag, kinds of spiders, etc. Study also the related forms, the tarantula, centipede, and scorpion.

f. Brief study of sprays and spraying as means of controlling insect pests.

8. Earthworms.
   a. Follow the outline suggested for the previous grade, studying more carefully the food, time of feeding, and relation to the soil.
   b. The earthworn as a subsoiler.
   c. Relation to humus content of soil.
   d. As a soil aerator.

9. Bat.
   a. Peculiar characteristics of the bat.
      1. Kind of coat.
      2. Kind of feet.
      3. Wings.
      4. Mammalian feature.
   b. Food of bats.
   c. Time of feeding.
   d. Hibernation during winter.
   e. Place of rest during the day.

f. Capture a bat and place it in a cage for study. Study its food habits by having the children collect food and feed it.

10. Snakes, Lizards, Terrapins, Frogs, Etc. Continue the study of these and other animal forms. Study carefully the food habits of frogs and snakes. Make a list of the poison snakes found in Texas.

III. SANITATION AND HYGIENE.

General problems of cleanliness around the school and home; the water supply; sewage disposal; garbage disposal; location of the barn and poultry yard with relation to the house; location of the well with relation to all other buildings.

IV. HOME GROUNDS.

Make a plan of the home grounds locating the buildings, fences, walks, drives, trees, shrubbery, and flowers. Discuss the preparation of the ground for planting trees, shrubs, and flowers; kinds to plant and where to get them; planting; arrangement and care.

V. SCHOOL GROUNDS.

Draw a plan of the school grounds locating the walks, trees, shrubbery, flowers, and well. Discuss the plans, criticise the present situation, and make suggestions for a better plan.

VI. SPANISH MISSIONS.

Stories of the founding of the missions, their construction, purpose, etc., to give the child a greater appreciation of their early influence for good.

SIXTH GRADE

"Nature study, while standing in its own light, should greatly enrich, elucidate, and vitalize the other studies. If properly handled, it should gradually give place to the services and vocations which it has served to develop and to introduce."

The nature study in the sixth grade should take on more economic features and should become more closely related to agriculture. The work, if properly taught, will be gradually merged into agriculture. The child should be placed more largely on his own resources, should be given more freedom of study, and more responsibility. His thought should be directed along economic lines in so far as is deemed wise, but the teacher must not lose sight of the fact that the economic phase is not the all-important phase of the work. He must be so taught that he will see and appreciate the beautiful in nature, and thus be equipped to live more fully and completely.

I. GARDENING.

1. Cuttings. Make cuttings of the geranium, coleus, begonia, etc., and propagate them in flower pots.

2. The Flower Garden. Plan a flower garden. Study the methods of propagation, the care and cultivation of the flowers to be grown in it.

3. Flower Festival. Plan a flower festival for the school and show the parents the results of competitive flower gardening. Each student should take part in the flower festival and should exhibit only his own flowers.

4. Marketing Flowers. If convenient to a city, interest the children in supplying flowering plants and flowers to the florists.

5. Vegetables.
   a. Early, hardy. Asparagus, rhubarb, beet, cabbage, carrot, cauliflower, lettuce, radishes, peas, onions, potatoes, parsnips, etc.

b. Late, tender. Corn, beans, tomatoes, peppers, cucumbers, etc.

6. Hot Beds. Construction of hot beds for vegetable gardening. Have the boys construct one on the school ground to grow plants for early planting in the school or home garden.

7. Cold Frames. Construction and use.

8. Adaptation of Vegetables. Study the vegetables best adapted to growth in the community.

9. Vegetables for Early Markets. Special study of radishes and lettuce for the early market. Other vegetables may be studied according to their importance in the community.

10. Tomatoes and Cabbage. Review the cultivation, and study the care and handling.

11. Potatoes. Special study of the Irish and sweet potatoes as to soil conditions, planting, cultivation, harvesting, yield, storing, and marketing.

12. Beans and Peas. Careful study of these and their effect upon the fertility of the soil.

13. Gardening Implements. Study the use and care of all tools used in cultivating the garden.

14. Insect Pests. Careful study of the insects injurious to garden crops.

15. Fungus Diseases. Brief study as to the damage done, the spread, and the control.

16. Income from Crops. Compare the income from an acre of potatoes with the income from an acre of cotton; beans; peas.

II. FIELD CROPS.

1. The Corn Crop.
   a. Number of acres planted on each farm.
   b. Average yield per acre.
   c. Number of acres planted in Texas.

d. Average yield per acre.
e. Average yield of corn club boys.
f. Get information on growing one acre of corn from the United States Department of Agriculture. Study carefully the best methods of plowing the land; time and rate of planting; habit of growth of plant; cultivation; harvesting and utilization of crop. Compare the cultivation advocated by the United States Department of Agriculture with the cultivation practiced on farms with which you are familiar.
g. Interest the children further in pure-bred grains. Select samples of ten ears each from the acre grown the preceding year and samples from the other fields grown on the same farm. Compare.

2. Oats, Wheat, Barley, Kafir Corn, Milo Maize, Feterita, and Rice. Brief study of each to familiarize students with the crops, their habits of growth, and their uses.

3. The Cotton Crop.
a. Importance in Texas.
b. Preparation of land for planting.
c. Time of planting.
d. Cultivation and care.
e. Time of harvesting.
f. Uses of the crop.
g. Enemies and their control.
h. Method of harvesting.
i. Care and handling after harvesting.

4. The Clovers.
a. Identification of all the wild and cultivated clovers.
b. Importance to the farm.
c. Uses of the different clovers.
d. Value of each as a nitrogen storer.
e. The bumble bee in relation to seed production.

5. Alfalfa, Cowpeas, and Soy Beans.
a. Habit of growth.
b. Uses of crop.
c. Care and handling.

6. Grasses. Care, importance, economic value of each in Texas meadows and pastures.

7. Weeds.
   a. List of weeds most troublesome on the farm.
   b. Weeds injurious to the garden.
   c. Collect samples of seeds from twenty-five noxious weeds and learn to identify the weed by its seed.
   d. Examine samples of wheat, clover, and alfalfa for weed seed.
   e. Classify all weeds studied according to their length of life and tell ways in which they cause harm.
   f. Study the habit of growth, manner of dissemination and method of eradication of some of the worst weeds.

8. Trees.
   a. Valuable for timber.
      1. Study the school building and its furniture, naming the trees from which the lumber was made.
      2. Kinds of lumber used in farm buildings.
      3. Timber used for fencing.
      4. The black locust for post timber.
   b. Rate at which our timber trees are disappearing.
   c. Trees used for shade and ornamental purposes.
   d. Planting trees.
   e. Care of trees, giving special emphasis to pruning and spraying.
   f. Enemies of trees. Insects, borers, forest fires, man, etc.
   g. Forest preservation and reforestation.

9. Fruits. Their culture and uses.
   a. Pome fruits. Apple, pear, quince.
   b. Stone fruits. Peach, plum, cherry.
   c. Citrus fruits. Orange, grape, lime, lemon, etc.
   d. Bush fruits. Dewberry, blackberry, gooseberry, currant, etc.
   e. Nut fruits. Pecan, walnut, hickory nut, etc.
   f. Grapes, strawberries, figs, and persimmons.
   g. Enemies of fruit-bearing plants and fruit, and their control.

III. ANIMAL LIFE.

1. Farm Animals. Continue the study of types and breeds as suggested for the fifth grade. Encourage the boys to feed a pig or a calf for the market. Have a live stock show at the school building, and have each student exhibit poultry, pigs, calves, cows, or any other form of live stock competitively. Have a competent judge place the animals in each class and award prizes or ribbons.

   a. Cattle. Beef, dairy, and dual purpose.

   b. Horses. Draft, coach, and roadster.

   c. Pigs. Bacon and lard type.

   d. Sheep. Fine wool, mutton, and dual purpose.

   e. Goats. Milk, and those bred for fleece.

   f. Care of live stock.

      1. Good barn accommodations with reference to warmth, light, ventilation, and cleanliness.
      2. Exercise, watering, and grooming.
      3. Treatment of common diseases.
      4. Dehorning cattle.
         a. Advantage.
         b. Methods.
      5. Live stock sanitation on the farm.
         a. Care of stalls.
         b. Necessity of clean water.
         c. Danger of ponds and pools as watering places, etc.

   g. Feeds and feeding.

      1. Kinds of feed used.
      2. Conveniences for feeding.
      3. Time and manner of feeding.
      4. Amount of feed required daily for different animals.
      5. Estimated cost of feeding a horse for one year.
      6. Cost of feeding a cow for one year.
      7. Become familiar with such terms as protein, carbohydrates, fats, etc. Learn what is meant by balanced ration, nutrition, etc.

h. Dairying.
   1. Breeds of dairy cattle.
   2. Breed most prominent in your community.
   3. Milk-producing ration for the dairy cow.
   4. Sanitary conditions around the dairy.
   5. Clean handling of milk.
   6. Testing milk for butter fat.
   7. Cream separation.
   8. Selling the dairy products.
   9. The silo as related to the dairy.

2. Birds.
   a. Poultry.
      1. Types of chickens.
      2. Most important breeds of each type.
      3. Characteristics and habits of the more prominent breeds.
      4. General principles of poultry management.
         a. Season to hatch so that pullets will become winter layers.
         b. Food necessary to egg production.
         c. Best age for selling male birds.
         d. Age at which hens usually cease to be profitable.
         e. Use of incubators in the poultry industry.
         f. Care of young chicks.
         g. Care of full grown birds.
         h. Diseases of poultry, their prevention and cure.
         i. Poultry houses.
   b. Wild birds.
      1. Birds that feed almost wholly on insects. Swallows, woodpeckers, wrens, etc.
      2. Birds feeding on both vegetable and animal food. Blue jay, catbird, robin, mockingbird, etc.
      3. Birds that feed largely on weed seed. The sparrows, finches, doves, meadow larks, and quails.
      4. Birds that eat the cotton boll weevil. More than thirty birds are known to feed on the cotton

boll weevil in Texas. Many others probably aid the farmer in holding this pest in check. The swallows, nighthawks, blackbirds, meadow larks, orioles, quails, and others feed heavily on it at certain seasons of the year.

5. Birds that live almost wholly on rodents. Some of our hawks and owls.
6. Study the food habits of all the resident and migratory birds and determine their economic value to the community.
7. Enemies of birds and their control. Man, snakes, cats, minks, foxes, English sparrows, etc.
8. Practicums.
   a. Allowing one bird to each acre, and one-fourth ounce of weed seed for each bird daily, how many pounds of weed seed would the birds on a one hundred-acre farm eat in three months?
   b. Mocking birds have been known to feed their young one hundred and eighteen to one hundred and fifty times daily, and it is a common thing for a wren to feed its young two hundred times daily. The food of all nestlings is insects. Allowing a pair of birds for every two acres, and two hundred insects daily for each nest, how many insects would be destroyed on a one hundred-acre farm in one month?

3. Aquatic and Semi-Aquatic Animal Life.

a. Brief study of the fish in the streams of Texas. Study the kinds; time of spawning; food habits; peculiar characteristics; best season for fishing; game laws protecting in other states; lack of protection in Texas, etc.

b. Brief study of alligators, crocodiles, whales, and other forms.

c, Frogs. Food habits, life history, etc.

4. Insects.
   a. Pests.
      1. List of insects most injurious to growing crops.
      2. Insects injurious to stored grain.
      3. Common garden insects.
      4. Insects injurious to the orchard.
      5. Insects injurious to live stock.
      6. Enemies of public health.
      7. Household pests.
   b. Classification of insects as regards manner of obtaining food.
      1. Sucking insects.
      2. Biting or gnawing insects.
   c. Control.
      1. Natural enemies: birds, toads, frogs, lizards, spiders, other insects, etc.
      2. Spraying.
         a. For sucking insects; kerosene emulsion, whale oil soap, and sometimes lime sulphur is effective.
         b. For gnawing insects: Paris green, arsenate of lead, hellebore, etc.
      3. Fumigation.
         a. For stored grains: carbon bisulphide or hydrocyanic acid gas.
         b. For deep-borers: squirt a small amount of carbon bisulphide in the holes and stop up with putty.
         c. For woolly aphis, root louse of apple, phylloxera or any scale or sucking insects on young plants for transplanting, fumigate with hydrocyanic acid gas.
         d. Demonstration of fumigation methods may be given by the teacher. Students should not be allowed to handle any poisons through this grade.
      4. Shallow-boring insects may be dug out from under the bark with a sharp knife.

d. Cost of control. Compare cost of control with the amount of damage done annually.

e. Beneficial insects.
   1. Make a list of insects helpful to man.
   2. Ways in which they are helpful.
   3. Protection of beneficial insects.

f. Become familiar with the life histories of all of the most troublesome insect pests.

g. Make a collection of insects for the school-room. Mount those that may be kept in mounts, and preserve others in formalin solutions or alcohol.

IV. MAKE PLANS FOR VACATION WORK BEFORE LEAVING SCHOOL.

Each student should have one or more projects and should have his work on these carefully outlined for the summer.

V. PLANS OF IDEAL COUNTRY HOUSE WITH WATER, LIGHTS AND SEWAGE.

VI. PLAN OF THE HOME GROUNDS AS YOU WOULD LIKE THEM.

SEVENTH GRADE

The work in the seventh grade should be given as elementary agriculture. The state-adopted text, Ferguson and Lewis's "Elementary Principles of Agriculture," should form the basis of work. This should be supplemented largely by readings from other texts and a large amount of bulletin work. There are a large number of texts on elementary agriculture published today, and an abundance of usable material in the form of farmers' bulletins and other bulletins and circulars issued by the United States Department of Agriculture and the experiment stations of the various states. Each school in Texas should receive also some good farm papers and one good daily paper. One good farm paper, one of the semi-weeklies with a farm department, and one poultry journal should be placed on the reading desk of every rural school regularly and the students should be encouraged to read them.

I. SOIL.

1. Physical Properties.
   - a. Origin. Directly or indirectly from the disintegration of rocks. Disintegration is caused by prolonged action of heat, cold, air, water, frost, etc., and by low forms of animal and vegetable life.
   - b. Classification of soils with reference to origin.
     1. Sedentary soils.
     2. Transported soils.
        - a. Agencies of transportation.
        - b. Kinds of transported soils.
   - c. Classification of soils with reference to their constituents.
     1. Sandy soils.
     2. Clay soils.
     3. Loamy soils, etc.
   - d. Classification of soils with reference to moisture.
     1. Arid.
     2. Semi-arid.
     3. Humid.

e. Soil temperature.
    1. Influenced by color of soil.
    2. Influenced by fineness of soil particles.
    3. Exposure.
    4. Drainage.

f. Soil moisture.
    1. Kinds. Hygroscopic, capillary, and hydrostatic.
    2. Kinds utilized by plants.
    3. Kind of soil losing or absorbing moisture most readily.
        a. Effects of different kinds of cultivation on soil moisture.
        b. Best methods of conserving.
        c. Function of soil moisture.

g. Irrigation.
    1. Methods of applying water.
    2. Benefits of irrigation.

h. Drainage.
    1. Kinds of drains.
    2. Benefits of drainage.

i. Careful study of subsoil.

2. Chemical Composition of the Soil.

a. Elements present in the soil—carbon, oxygen, hydrogen, potassium, phosphorus, nitrogen, sulphur, lime, iron, magnesium, silica, etc.

b. Relative importance of each element.

c. Elements abundant in the soil.

d. Special study of lime, potash, phosphorus and nitrogen, and their relation to farm products.

e. Alkali and acid soils.
    1. Tests for acidity.
    2. Effect on crops.
    3. Neutralization.

f. Humus. Decaying organic matter composed of carbon, hydrogen, oxygen, nitrogen, mineral elements, etc.
    1. Importance of humus.
        a. Nitrogen supply.
        b. Mineral plant food supply.

c. Effect on retention of moisture.
d. Source of warmth.
e. Improver of texture.
f. Aid to bacteria and other micro-organic growth in soil.
g. Preventive of washing and leaching.

3. Soil Fertility.

a. Causes for decreased production of soils.
   1. Loss of the essential plant food elements.
   2. Loss of humus.
   3. Poor physical condition of soil.

b. How constituents are lost.
   1. Continued growth of tilled crops.
   2. Leaching.
   3. Washing.

c. Commercial plant food.
   1. Nitrogen.
   2. Phosphorus.
   3. Potassium.

d. Source of fertilizers. Emphasize the use of leguminous crops for nitrogen; the use of ground rock phosphate and agricultural lime.

e. Humus.
   1. Loss of humus.
   2. Increase of humus content.
      a. Green manures.
      b. Farm manures.
      c. Accumulations in pasturing.

f. Barnyard manures.
   1. Value (factors influencing).
   2. Amount produced by farm animals.
   3. Care and handling of manures.
   4. Application of manure.

g. Green manuring.
   1. Importance.
   2. Kind of crops used.

h. Careful study of the needs of Texas soils.

4. Rotation of Crops and Conservation of Soil Fertility.
   a. Purpose of crop rotation.
   b. Advantages.
   c. Plan of rotation for your community.

5. Preparation of Soils for Crops.
   a. Time of plowing.
   b. Depth of plowing.
   c. Methods of cultivation after plowing.
   d. Object of cultivation.
      1. To improve physical condition.
      2. Conserve soil moisture.
      3. Destroy weeds.
      4. Destroy insect pests.
      5. Aid in liberating plant food.

II. PLANTS.

1. Plant Structure.
   a. The cell—the unit of structure.
   b. Structure and function of stem, roots, leaves, flower and seed.
      1. Compare structure of monocotyledons and dicotyledons.
   c. Structure and habits of a typical fungus.
   d. Reproduction in plants.
      1. Spores.
      2. Seed.
      3. Vegetative.

2. Seed Study.
   a. Collect seeds of all the grain and forage crops growing in the district, classifying as follows:
      1. Seeds from strong, healthy plants.
      2. Seeds from weak plants.
   b. Test samples of each for
      1. Purity.
      2. Vitality.
      3. Effect on germination.
         a. Different types of soil.

b. Size of seeds.
c. Age of seeds.
d. Character of plant from which seed is taken.
e. Depth of seeding.
f. Moisture.
g. Temperature.
h. Air.

c. Importance of seed selection in improving crops.
d. Best method of selecting seed grain.
e. Importance of proper curing and storage.
f. Value of germination test.

3. Farm Crops.
   a. Corn.
      1. History and types.
      2. Varieties grown in Texas.
         a. Boone County White.
         b. White and yellow gourd seed.
         c. Munson.
         d. Hickory King.
         e. Laguna.
      3. Corn judging by the use of score card adopted by Texas State Corn Growers' Association.
      4. Method and value of testing seed for germination.
      5. Study of corn plant.
         a. Root system. Extent of feeding.
         b. Stem—typical monocotyledons.
         c. Flowers.
            1. Tassel-staminate.
            2. Ear-pistillate.
      6. Plowing corn. Time, depth, etc.
      7. Preparation of seed bed.
      8. Planting. Time, distance, depth, etc.
      9. Cultivation.
         a. How to cultivate.
         b. Time to cultivate.
         c. Shallow against deep cultivation.

10. Selecting seed corn.
    a. Importance of selecting.
    b. Method of selecting.
    c. Time to select.
11. Harvesting corn.
    a. Degree of maturity for silage.
    b. Degree of maturity for fodder.
    c. Degree of maturity for ears only.
    d. Decrease in yield from pulling fodder and topping corn.
12. Care of crop after harvesting.
13. Uses of crop.
    a. Feed for live stock.
    b. Human food.
    c. Commercial products.
14. Yield of corn.
    a. Acreage for the United States.
    b. Average yield per acre.
    c. Acreage for Texas.
    d. Average yield per acre.
15. Methods of corn improvement.
    a. Seed selection in the field.
    b. Corn breeding.
16. Enemies of corn—control measures.

b. Cotton.

1. History and types.
2. Principal Texas varieties.
    a. Mebane.
    b. King.
    c. Russel.
    d. Rowden.
3. Study of the cotton plant.
    a. The stem, roots, branches, flowers, and boils.
    b. The lint and seed.
4. Cotton cultivation.
    a. Plowing. Time, depth, method of preparing land, etc.
    b. Testing the seed for germination; method and importance of.

c. Planting. Time, distance, depth, etc.
d. Tillage. Methods, time, depth, frequency, etc.
e. Fertilizers for cotton.

5. Selecting seed cotton.
   a. Importance of selecting.
   b. How to select seed.
   c. Time to select seed.
6. Harvesting, marketing and storing.
   a. Picking and ginning cotton.
   b. The commercial classes or grades of cotton.
   c. Marketing. Time, method, etc.
   d. Storing. In the open, under sheds, warehouses, etc.
7. Uses of cotton.
   a. Fibre. Clothing and shelter.
   b. Human food. Cotton seed, flour and oil.
   c. Feed for live stock.
8. Cotton statistics.
   a. The total cotton crop of the world.
   b. Acreage, yield and value of cotton crop in the United States.
   c. Acreage, yield and value of cotton crop in in Texas.
9. Methods of cotton improvement.
   a. Seed selection in the field.
   b. The seed patch.
10. Cotton insects. Boll weevil, boll worm, cotton-leaf worm, etc.
11. Cotton diseases. Root rot, cotton wilt, etc.

c. Wheat.

1. Origin and importance.
2. Name and locate the leading wheat-producing states.
3. Preparation of seed bed.
4. Sowing. Depth, distance between drills and amount per acre.
5. Cultivation after sowing.
6. Conditions favorable to wheat crop.

7. Pasturing wheat. How injurious.
8. Degree of maturity for harvesting.
9. Method of handling wheat before threshing.
10. Threshing.
11. Care of stored grain and marketing.
12. Products of wheat kernel.
13. Value of wheat crop.
14. Yield in Texas.
15. Cost of production.
16. Enemies of wheat crop.

d. Oats, barley, and rye. Study under outline suggested for wheat.

e. Alfalfa.
   1. Varieties.
   2. Study of the alfalfa plant.
      a. Root system. Length, depth and nodules.
      b. Leaf. Number of leaves and leaflets.
      c. Stem. Length, size, and general appearance.
      d. Examine seed for impurities.
      e. Learn to recognize the seed of alfalfa.
      f. Test seed for germination.
   3. Sowing alfalfa.
      a. Time of sowing. Fall versus spring.
      b. Kind of seed bed.
      c. Method of sowing.
   4. Time to cut alfalfa.
   5. Making hay.
   6. Number of cuttings per season.
   7. Amount of hay per acre.
   8. Value of hay as food for live stock.
   9. Production of alfalfa seed.
      a. Threshing.
      b. Yield per acre.
      c. Price per bushel.
   10. Relation of alfalfa to soil fertility.
      a. Nitrogen supply.
      b. Liming the soil for alfalfa.
      c. Replacing phosphorus and potassium.

f. Clovers, vetches, cowpeas, and soy beans. Study under outline suggested for alfalfa.

g. Grasses for hay: millet, Johnson grass, Sudan grass, rescue grass, etc.
   1. Study of seed as outlined for alfalfa.
   2. Preparation of seed bed.
   3. Seeding.
      a. Time to sow.
      b. Amount per acre.
      c. Method of sowing.
   4. Length of time from seeding to first hay crop.
   5. Time to cut for hay.
   6. Curing and caring for hay.
   7. Amount produced per acre.
   8. Value as a feed.
   9. Care of meadows.
   10. Length of life of meadows.

h. Grasses used for pastures. Bermuda, mesquite, buffalo, rescue grasses, etc.
   1. Value of permanent pastures.
   2. Care of pastures.
   3. Length of life.

i. Sorghums.
   1. Kinds.
      a. Saccharine. Amber, orange, goose neck, etc.
      b. Non-saccharine. Kaffir, milo, feterita, kowliang, etc.
   2. Preparation of seed bed.
   3. Seeding.
   4. Cultivation.
   5. Uses of sorghum.
      a. As human food.
      b. Food for live stock.
   6. Importance of sorghums in Texas.

j. Potatoes.
   1. Brief history of the potato.
   2. Kind of soil best suited to potato growing.
   3. Preparation of seed bed.
   4. Selection of seed potatoes.

5. Cutting the seed. Number of eyes, etc.
6. Planting. Distance apart, depth, etc.
7. Cultivation and harvesting.
8. What is considered a good yield? Does your locality produce a good yield?
9. Insect enemies of the potato. (Review life history of potato beetle.)
10. Diseases of the potato. Blight, rot, and scab.
11. Spraying.
    a. For potato bug, use arsenate of lead or Paris green.
    b. For potato blight, use Bordeaux mixture.
12. Importance of rotation of crops in preventing rot and scab.
13. Uses of the potato.

4. Weeds.
   a. Definition.
   b. Ways in which weeds cause harm.
      1. Reduce soil fertility.
      2. Reduce soil moisture.
      3. Shade and crowd growing crops.
      4. Poisonous weeds cause loss of live stock.
      5. Harbor insect pests and fungus diseases.
      6. Immense amount of labor required in controlling weeds.
      7. Presence of weed seeds lowers the price of threshed grains.
   c. Classification of weeds according to methods of reproduction.
      1. By seed alone. Annuals.
      2. By root alone. Horse radish.
      3. By stem and seed. Crab grass.
      4. By both root and seed. Johnson grass.
      5. By stem and root. Berumda grass.
   d. Classification according to methods of eradication.
   e. Make a careful study of the weeds in the district, and make a list of the (a) annuals; (b) biennials; (c) perennials.

f. Collect seeds in small bottles from twenty annuals, five biennials, and five perennials in the neighborhood.
g. Learn to recognize the weed by its seed.
h. Examine samples of alfalfa seed and millet seed, etc., for weed seed. Make an estimate of the number of weed seed per thousand of seed examined.
i. Agencies of weed dissemination. Wind, water, birds, animals, human beings, threshing outfits, railroads, weedy seed grain, etc.
j. Weed control.
    1. Select pure seed for the farm.
    2. Never allow a weed to mature seed.
    3. Have seed bed clean before planting any crop.
    4. Plant crops that will hold weeds in check.
    5. Proper rotation of crops.
k. Weed extermination.
    1. Spraying for certain annuals.
    2. Kerosene, gasoline, salt, etc., for certain perennials.
    3. Clean cultivation and summering fallow for all weeds.

5. Orchards.
a. Selecting the location with reference to drainage (air and water) conditions, exposure, etc.
b. Careful study of the soil and the subsoil for orcharding.
c. Adaptation of pear, apple, etc., to certain soils.
d. List of varieties grown in the community.
e. Suggested list of apples, plums, and peaches for Texas.
    1. Apples. Summer: Astrachan, Early Harvest, Red June, Summer Queen, etc. Fall and winter: Arkansas Black, Jonathan, Missouri Pippin, Winesap, etc.
    2. Plums. Burbank, Golden Beauty, Gonzales, Shire, Happiness, Nona, etc.
    3. Peaches. The cling varieties. Elberta, Mamie Ross, Onderdonk, etc. (Consult catalogue of nearest nursery for varieties best suited to your locality.)

f. Preparation of soil for planting.
    1. Cultivation for good tilth in surface soil.
    2. Subsoiling. Dynamiting and using subsoil plow.
    3. Fertilization.
g. Laying out orchard.
h. Planting the trees.
    1. Time to plant.
    2. Root pruning.
    3. Top pruning.
    4. How to plant properly.
i. Orchard soil management.
    1. Orchard cropping. Advantages and disadvantages.
    2. Clean culture. Advantages.
    3. Sod mulch. Advantages and disadvantages.
j. Propagation of fruits.
    1. Cuttings. Hardwood and green cuttings.
    2. Budding. T budding and ring budding.
    3. Grafting. Whip (root) grafting and cleft grafting.
    4. Layerage.
k. Pruning.
    1. Time to prune.
    2. How to prune.
    3. Effect on quality of fruit.
    4. Effect on quantity of fruit.
l. Improvement of fruits.
    1. Selection.
    2. Crossing.
m. Insect enemies and their control.
    1. Codling moth, San Jose scale, etc.
    2. Spray with lime sulphur, Paris green, etc.
n. Fungus diseases and their control.
    1. Mildew, scab, etc.
    2. Spray with Bordeaux mixture, lime sulphur, etc.
o. Spraying.
    1. Object of spraying.
    2. Time to spray.

3. Kinds of sprays and how to mix.
4. Spraying machinery.

p. Economic value of birds and toads to the orchard.

III. FARM ANIMALS.

1. HORSES.
   a. Origin and brief history.
   b. Types of horses. Draft, coach, roadster, saddle, and speed.
   c. Breeds of horses.
   d. Improvement of breeds.
   e. Care and management.
   f. Diseases.
   g. Judging horses. Practical work in telling age and judging.

2. CATTLE.
   a. Origin and history.
   b. Types and breeds.
      1. Beef. Shorthorns, Hereford, Aberdeen Angus, etc.
      2. Dairy. Jersey, Guernsey, Holstein, etc.
      3. Dual purpose. Brown Swiss, Devon, Red Polled, etc.
   c. Improvement of breeds.
   d. Care and management.
   e. Diseases. Special study of tuberculosis and the tuberculin test.
   f. Judging cattle.
   g. Value of cattle in maintaining soil fertility.

3. SHEEP.
   a. Native home.
   b. Present distribution.
   c. Types and breeds.
      1. Fine wool. Merino, Rambouillet, Delaine, etc.
      2. Middle wool. Southdown, Shropshire, Hampshire, etc.
      3. Long wool. Lincoln, Leicester, Cotswold.
   d. Improvement of sheep.

e. Value of sheep in maintaining soil fertility and as renovators of brush land.
f. Common diseases and their control.
g. Care and management of the herd.

4. Hogs.
   a. History and distribution.
   b. Types and breeds.
      1. Bacon type. Large Yorkshire, Tamworth, Hampshire, etc.
      2. Lard types. Poland China, Berkshire, Chester White.
   c. Improvement of hogs.
   d. Pure bred hogs and scrubs as to the cost of fattening.
   e. Care and management.
   f. Judging.
   g. Common diseases and manner of treatment.
   h. The brood sow. Care, shelter, and feed.
   i. Care of growing pigs.

5. Goats.
   a. Brief study of goats and their relation to agricultural conditions of Texas.

6. Poultry.
   a. Types and breeds.
      1. Meat breeds: Cochin, Brahma, etc.
      2. General purpose breeds: Plymouth Rock, Rhode Island Red, etc.
      3. Egg breeds: Leghorn, Minorca, etc.
      4. Ornamental breeds: Bantam, Game, etc.
   b. Care and management.
      1. Location and construction of houses.
      2. Houses should be floored, dry, well lighted, well heated, and well ventilated.
      3. Importance of cleanliness.
      4. Spraying and whitewashing of poultry houses.
      5. Feeding. Kind of feed, frequency, and amount of feeding.
      6. Improvement of poultry.

7. Raising chicks.
    a. Hatching. Incubators as compared with hens.
    b. Raising. Brooders as compared with hens.
    c. Feeding and care of chicks.
8. Preserving and marketing eggs.
9. Poultry diseases.
    a. Common diseases and their treatment.
    b. Loss caused by poultry diseases.
10. Insect pests.
    a. Lice and mites.
    b. Preventive measures.

7. Feeds and Feeding.
    a. Different kinds of feed used in community.
    b. Materials used for feed.
    c. Composition of feeds. Water, ash, protein, fat, crude fibre, nitrogen free extract.
    d. Function of different nutrients.
    e. Digestibility of different foods.
    f. Foods classified as concentrates; roughages.
    g. Uses of feed. Maintain animal, do work, and produce growth.
    h. Varying the food with the work.
    i. Amount and kind of feed required for live stock under various conditions.
    j. Importance of succulent feeds.
    k. Effect of feeding mouldy feeds.
    l. Regularity of feeding.
    m. Balanced ration. Work out balanced ration for different kinds of live stock with feeds in the community.

8. Dairying.
    a. Breeds of dairy cattle.
    b. Breeds best adapted for Texas conditions.
    c. Ration for dairy cow.
    d. Relation of the silo to the dairy.
    e. Location of the dairy barn with reference to other farm buildings.

f. Location of the milk room with reference to the rest of the barn.

g. Sanitary precautions.
   1. Clean stables and watering places.
   2. Keep cows in a cleanly condition.
   3. Cleanliness of clothing and person of attendant.
   4. Prompt removal of milk from stables.
   5. Clean, bright milking pails and milk cans.

h. Care of milk and its products.
   1. Cleanliness in handling.
   2. Creaming. Shallow pan versus cream separator.
   3. Ripening and churning cream.
   4. Making and salting butter.
   5. Wrapping, packing, and marketing the butter.

i. Value of skim milk and buttermilk as a feed.

j. Babcock test.
   1. Importance in building up herd.
   2. Apparatus and material for making the test.
   3. Method of making the test.
   4. Testing the cream, whole milk, skim milk, and buttermilk.

k. Importance of the dairy in maintaining and building up soil fertility.

IV. GOOD ROADS.

1. Types of roads. Careful study of the types of roads in the community.
2. Materials used in building.
3. Methods in building.
4. Elements that make up a good road.
5. Importance of drainage.
6. Character of the soil. Effect on the road.
7. Shell, gravel and limestone. Importance of each in road building.
8. Dirt and pike roads. Comparison of cost and service of the two.
9. Maintaining the road.
10. Road grading and road machinery.

11. Value of good roads to the community.
12. The good roads movement.

VII. FARM ARITHMETIC AND FARM BOOKKEEPING.

Give the students such problems as they will have to solve on the farm. Give them something other than text-book work. Ask them to make a problem relating to the farm and hand it in the following day. They will surprise you by handing in a splendid list of practical exercises. Teach a very simple method of bookkeeping, and the importance of farm accounts. Very few farmers know how they make their money, and if they do know how, they never know how much. It is important that the farmer know the cost of production of every farm product if he is to be successful.

BIBLIOGRAPHY OF REFERENCE BOOKS IN NATURE STUDY AND AGRICULTURE FOR THE RURAL SCHOOLS.

1. Allen—Flashlights on Nature. (Doubleday) $1 35
2. Apgar—Birds of the United States. (Am. Bk.) 2 00
3. Blanchan—Birds that Hunt and are Hunted. (Doubleday) 2 00
4. Blanchan—Birds that Every Child Should Know. (Doubleday) 1 20
5. Blanchan—Nature's Garden. (Doubleday) 3 00
6. Brooks—The Story of Cotton. (Rand) 75
7. Burkett & Poe—Cotton. (Doubleday) 2 00
8. Coburn—Alfalfa. (Judd) 50
9. Comstock—Handbook of Nature Study for Teachers. (Comstock Pub. Co.) 3 25
10. Comstock—The Bird Note Books, Nos. 1 and 2, each. (Comstock Pub. Co.) 30
11. Corbett—Garden Farming. (Ginn) 2 00
12. Cummings—Nature Study for Primary Grades. (Am. Bk.) 90
13. Cummings—Nature Study for Lower Grammar Grades. (Am. Bk.) 60
14. Cummings—Nature Study for Higher Grammar Grades. (Am. Bk.) 75
15. Davenport—Domesticated Animals and Plants. (Ginn) 1 25
16. Duggar—Fungous Diseases of Plants. (Ginn) 2 00
17. Duggar—Southern Field Crops. (Macmillan) 1 75
18. Halligan—Fundamentals of Agriculture. (Heath) ... 1 20
19. Hodge—Nature Study and Life. (Ginn) 1 50
20. Hornaday—Our Vanishing Wild Life. (Scribner) 1 50
21. Jackman—Nature Study for Grammar Grades. (Macmillan) 1 00
22. Kyle & Ellis—Fundamentals of Farming and Farm Life. (Scribner) 1 25
23. Lange—Handbook of Nature Study. (Macmillan) ... 1 00
24. Merriam—Birds of the Village and Field. (Houghton) 2 00

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26. Montgomery—The Corn Crops. (Macmillan)..... 1 50
27. Nature Study—Readers for the Grades. (Am. Bk.) .....35c to 1 25
28. Nature Study—Readers for the Grades. (World Bk. Co.) .....35c to 1 25
29. Parkhurst—How to Name the Birds. (Scribner)..... 1 00
30. Parkhurst—The Bird's Calendar. (Scribner)..... 1 50
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34. Reed—Nature Studies—Birds. (Doubleday)..... 60
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38. Robinson—Principles and Practices of Poultry Culture. (Ginn) 2 50
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42. Scott—Nature Study and the Child. (Heath)..... 1 50
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3. Andrews—The Call of the Land. (Judd) 1 50
4. Ashenhurst—The Day of the Country Church. (Funk) 1 25
5. Bailey—The Country Life Movement. (Macmillan) .. 1 25
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10. Bookwalter—Rural vs. Urban. (Knickerbocker Press) 4 00
11. Burbank—The Training of the Human Plant. (Century) 60
12. Butterfield—Chapters in Rural Progress. (Chicago Univ. Press) 1 00
13. Butterfield—The Country Church and the Rural Problem. (Chicago Univ. Press) 1 00
14. Carver—Principles of Rural Economics. (Ginn) 1 30
15. Collins—New Agriculture. (Munn) 2 00
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17. Davenport—Education for Efficiency. (Heath) 1 00
18. Dean—The Worker and the State. (Century) 1 20
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27. Gowdy—Poems for the Study of Language. (Houghton) 40
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35. King—Social Aspects of Education. (Macmillan) 1 60
36. Leland—Playground Technique and Playcraft. (Bassette) 2 50
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48. Wilson—The Church of the Open Country. (Missionary Educ. Mov.) 50
49. Wray—Jean Mitchell's School—Public School 1 00
50. Report of the Country Life Commission. (Sturgis & Walton) 75

Addresses of Publishers and Key to Abbreviations.

Am. Bk.—American Book Co., Chicago, Ill.

Appleton—D. Appleton & Co., Chicago, Ill.

Baker—The Baker & Taylor Co., New York, N. Y.

Bassette—F. A. Bassette Co., Springfield, Mass.

Century—The Century Co., Union Square, New York, N. Y.

Charities Pub. Com.—Charities Publication Committee, New York, N. Y.

Chicago Univ. Press—University of Chicago Press, Chicago, Ill.

Comstock Pub. Co.—Comstock Publishing Co., Ithaca, N. Y.

Doubleday—Doubleday, Page & Co., Garden City, N. Y.

Flanagan—A. Flanagan Co., Chicago, Ill.

Funk—Funk Wagnalls Co., New York, N. Y.

Ginn—Ginn & Co., Boston, Mass.

Gorham—The Gorham Press, Boston, Mass.

Heath—D. C. Heath & Co., Chicago, Ill.

Houghton—Houghton, Mifflin & Co., Boston, Mass.

Knickerbocker Press—The Knickerbocker Press, New York, N. Y.

Lippincott—J. B. Lippincott & Co., Philadelphia, Pa.

Macmillan—The Macmillan Co., New York, N. Y.

Missionary Educ. Mov.—Missionary Education Movement, 156 Fifth Ave., New York City, N. Y.

Munn—Munn & Co., New York, N. Y.

Outing Pub.—Outing Publishing Co., New York, N. Y.

Pilgrim Press—The Pilgrim Press, Boston, Mass.

Public School—Public School Publishing Co., Bloomington, Ill.

Rand—Rand-McNally & Co., Chicago, Ill.

Scribner—Charles Scribner's Sons, New York, N. Y.

Sower—Christopher Sower Co., Philadelphia, Pa.

Sturgis & Walton—Sturgis & Walton, New York, N. Y.

Webb Pub.—Webb Publishing Co., St. Paul, Minn.

Whitcomb & B.—Whitcomb & Barrows Co., Boston, Mass.

World Book Co.—World Book Co., Yonkers-on-Hudson, N. Y.

Y. M. C. A.—International Com. of Y. M. C. A. Press, 124 East Twenty-eighth St., New York, N. Y.

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